Commentary

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Application of Machine Learning Algorithms in Medical Field to Potentially Improve Diagnosis and Predict Clinical Outcomes

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Description

Artificial Intelligence (AI) in healthcare is the application of machine learning algorithms in medical field to potentially improve diagnosis and predict clinical outcomes. The advancements in computing power and vast data curation within health systems have led algorithm development that can assist healthcare providers as Clinical Decision-Support (CDS) tools. A myriad of AI applications exist within healthcare such as using electronic health record data for risk predictors, early prediction and diagnosis of diseases such as sepsis, and continuous disease monitoring using wearable devices. There have been innovative efforts to procure large number of medical image datasets either within institutions or for public use such as DeepLesion which contains 32,000 computed tomography images for scientific studies or National Institutes of Health Chest X-Ray Dataset. Computer vision is a field of AI in which the system learns to interpret visual images. It has advanced the process of medical image evaluation with higher accuracy and more efficient analysis.

Image Classification and Objection Detection

The Convolutional Neural Network (CNN) is a type of artificial neural network that has revolutionized image analysis without the need to extract traditional handcrafted features such as colors, intensity value, topological structure, and texture information. Researchers have developed deep learning models that have been trained on millions of images for different tasks such as image classification, object detection and image recognition. Model development for computer vision challenges such as image classification and objection detection is achieved by training and testing on millions of images. These models, most notably inspired by ImageNet, CIFAR, MNIST, COCO, Open Images, and SUN challenges, can either detect or classify numerous different categories such as dogs or cats in a given image with a high accuracy. Medical imaging field has adapted these CNN methods to solve a diverse array of problems using datasets obtained from various imaging modalities such as chest x-rays, magnetic resonance imaging, pathology, and ophthalmology. In medical image analysis, lack of data creates a bottleneck for training a deep learning model.

Challenges Preventing AI from Being More Widely used in Dermatology

Acquiring and annotating medical images is costly, time consuming, and labor intensive. Data sharing may serve as a potential solution to accelerate data collection but ethical and privacy issues can hinder institutional data sharing. Hence, *transfer learning* has vastly improved the medical imaging field by allowing the use of models that have been pretrained on millions of images to solve numerous medical imaging problems, alleviating the need to spend hours building an effective model or collecting vast amounts of clinical data. Pretrained models can be fine-tuned to unique problems according to amount of available data and the data similarity. Deep learning has immense potential in dermatology as an assistive diagnostic tool for skin diseases with promising value in assisting diagnostic and disease quantification tasks. Clinical use span clinical care, teledermatology, triaging care, clinical trials amongst others. The most pressing challenges preventing AI from being more widely used in dermatology is the lack of diversity in datasets and generalizability studies. Working together with physicians and healthcare providers, these AI algorithms can provide more accurate diagnosis and better care, reduce labor costs and workload, and benefit healthcare industry overall.